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Place of Summer Fallow in the Agriculture of the Western States[1]

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United States Department of Agriculture, in cooperation with the State agricultural experiment stations of Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming

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INTRODUCTION

The moisture-saving practice of summer fallowing is carried on to a greater or lesser degree throughout the nonirrigated western United States. The extent to which it is used or should be used depends on its effect on the quantity, economy, and stability of production, and other factors.

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[1] This material was assembled at the suggestion of the Western Soil Research Committee. The representatives of the different States who contributed material are: P. S. Burgess, Arizona; B. A. Madson, California; D. W. Robertson, Colorado; G. O. Baker, Idaho; A. B. Erhart, Kansas; A. E. Seamans and T. S. Aasheim, Montana; L. L. Zook, Nebraska; H. G. Mason, Nevada; J. E. Chapman, New Mexico; C. C. Volkerding and T. J. Conlon, North Dakota; H. F. Murphy, Oklahoma; M. M. Oveson, Oregon; L. F. Puhr and A. N. Hume, South Dakota; E. B. Reynolds, Texas; D. W. Thorne, Utah; L. C. Wheeting and H. D. Jacquot, Washington; and W. L. Quayle and G. H. Bridgmon, Wyoming.

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These are in turn affected by other considerations, such as the kind of crops grown, the competition afforded by replacement crops, the type of farming practiced, the weed control needed and afforded, erosion hazards, and the ultimate effect on the soil. The fallow acreage may also be changed by forced adjustments in cropping practices brought about by acreage controls and by the relation between production costs and crop prices. Fallowing enables a farmer to operate nearly twice the acreage of land without additional equipment.

Need for summer fallow varies. It is relatively easy to outline areas where it is necessary to crop production, but it is very difficult to delineate areas where fallowing is highly desirable though not essential, where its use is optional, and where it should not be a part of the regular farm practice. For example, in some areas fallow is essential to the production of winter wheat but not for the production of other cereals; in others it is essential to the production of the small grains but not row crops; and in still others fallow is desirable for production of both cereals and certain types of row crops.

EFFECT OF RAINFALL DISTRIBUTION ON MOISTURE STORAGE IN FALLOW AND ON CROP RESPONSE

Fallowing is a farm practice both in areas where precipitation occurs chiefly in summer and in areas where the heaviest precipitation is in winter. The summer-type rainfall prevails throughout the Great Plains, and the winter-type precipitation in the Columbia River Basin and the Intermountain region. The effectiveness of the fallowing operation on the storage and efficient use of water is governed to a great extent by the rainfall pattern.

An illustration of the difference between summer and winter patterns is presented in figure 1, which shows the monthly distribution of precipitation at Akron, Colo., and Pendleton, Oreg. At Akron, 71 percent of the 17.45-inch annual precipitation falls during the period from April to August, inclusive. At Pendleton, 56 percent of the annual rainfall occurs during the period from November to March, inclusive.

A much greater percentage of the precipitation can be stored in the soil at Pendleton than at Akron. Exact comparisons are not available, but it is known that on fallowed land at Pendleton the capacity of the soil for moisture storage is fully utilized in most years. At Akron, on the other hand, full use of the moisture-storage capacity is the exception. Most of the precipitation at Akron occurs during a period of the year when temperatures are high; therefore, a much greater part of it is lost by evaporation. There is the additional factor that as summer rains are more frequently torrential, there is some loss by runoff.

The rainfall pattern is also important in determining the quantity of soil nitrogen that becomes available to crops. At Pendleton, the rainfall after wheat harvest is very low through the summer, and rainfall sufficient for nitrification to take place seldom occurs until fall temperatures have become too low for active bacterial action. Consequently, wheat planted on land without an intervening fallow period generally has too little available nitrogen to take full advantage of its moisture supply. One of the great benefits of fallow at

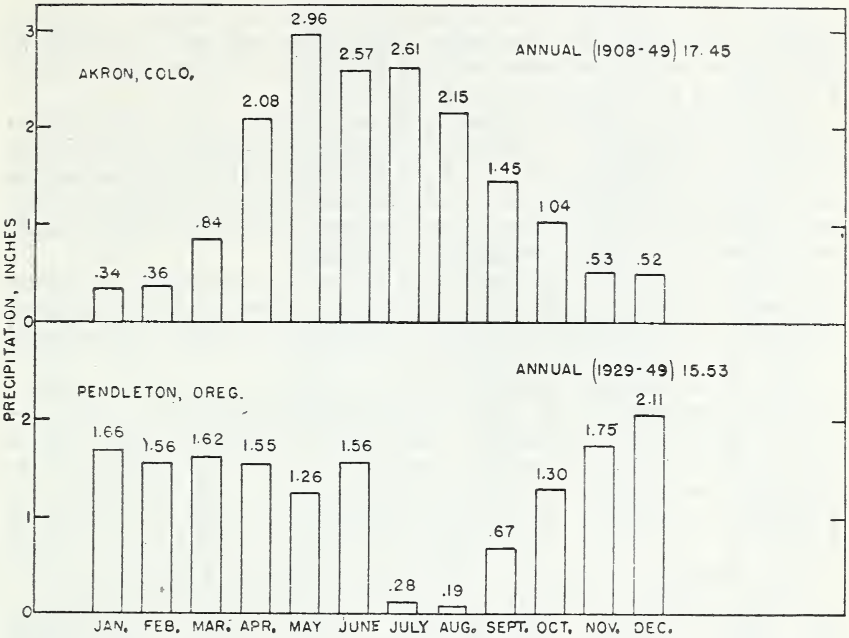

Figure 1.—Precipitation, by months, at Akron, Colo., and Pendleton, Oreg.

Pendleton is that it provides moisture at a time when soil temperatures are suitable for nitrification. Under a summer rainfall, as at Akron, nitrification is likely to be adequate in most years.

The effectiveness of fallow in influencing crop yields and stabilizing production under the two types of rainfall patterns is shown in table 1. Data from Hays, Kans., with a summer-type rainfall of about 22 inches are included for comparison.

Table 1.—*Percentage of wheat yields in different yield categories at 2 locations in the Great Plains and 1 in the Columbia River Basin*

Yield category per acre	Wheat on fallowed land			Wheat after wheat		
	Akron, Colo.	Hays, Kans.	Pendleton, Oreg.	Akron, Colo.	Hays, Kans.	Pendleton, Oreg.
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Under 5 bushels	15	17	0	44	33	0
Under 20 bushels	61	36	0	88	62	100
Over 20 bushels	39	64	100	12	38	0
Over 40 bushels	5	12	83	0	5	0

Yields under 5 bushels to the acre may be classed as failures or near failures. The reduction in failures through fallowing is shown in the table. At Akron the percentage of failures under a fallow system was only one-third as high as under an annual cropping system. At Hays the percentage of failures was only one-half as high under fallow as under annual cropping. There was no complete failure at Pendleton under either system.

One hundred percent of the yields on cropped land at Pendleton fell below 20 bushels. No yield of less than 20 bushels to the acre was obtained on fallowed land. At both Akron and Hays the percentage of yields below 20 bushels was substantially lower on fallowed than on cropped land. At Akron, however, even on fallowed land, yields were below 20 bushels three-fifths of the time.

Yields of more than 20 bushels to the acre were tripled at Akron and nearly doubled at Hays by fallowing. However, the percentage of yields in this category was about as high on annually cropped land at Hays as on fallowed land at Akron.

The effectiveness of fallow in promoting high acre yields is shown by the percentages in the more-than-40-bushel category. Five percent of the yields on fallow at Akron were above 40 bushels; none of the yields under continuous cropping was as high as 40 bushels. At Hays the comparable percentages were 12 and 5, respectively. At Pendleton 83 percent of the yields on fallowed land were above 40 bushels to the acre. Under annual cropping, no yield of as much as 20 bushels was obtained without use of nitrogen fertilizers.

Table 1 illustrates two of the major differences between the summer- and the winter-rainfall areas. In the summer-rainfall area, yields as high as those on fallowed land are sometimes obtained on annually cropped land. This almost never occurs in the winter-rainfall area. Crop failures on land that has been fallowed are much more frequent in the summer-rainfall area.

For these reasons, fallowing is not so stable a practice in the summer-rainfall area and the acreage of fallowed land is subject to much wider variations.

SUMMER-FALLOW ACREAGE AND USE

Table 2 gives the acreage of fallow in the 17 Western States[2] and its use in different cropping systems. It is necessary to discount the figures in this table on the total amount of fallow in the western United States. The totals show that the annual acreage is from 17 to 21 million acres. These figures are undoubtedly too high. In States where fallow is a necessity, the acreage is relatively stable and the figure given is fairly accurate. In areas where the use of fallow is optional, yearly changes are great and the fallow-land total may include a considerable acreage of idle or abandoned land. In the statistics available, these lands are not separated from land being fallowed to store moisture. Several million acres could be deducted from the total without doing injustice to the facts concerning the value of fallowing.

For convenience in discussion, the region has been divided into a winter-rainfall area and a summer-rainfall area. The summer-rainfall area has been further divided into the northern Plains, central Plains, and southern Plains.

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[2] The general information in this table was compiled from reports sent in by representatives appointed by the directors of the respective States.

TABLE 2.—*Summer-fallow acreage and use in 17 Western States*

Area and State	Area of fallow [1]	Dry-farmed land in fallow	Portion of State to which fallow is adapted	Place of fallow in the cropping system
Winter-rainfall area				
Western States:	*Acres*	*Percent*		
Washington	2, 100, 000	40	Columbia River Basin and western fringe of Palouse district.	Necessary for satisfactory crop production in sections with less than 15 inches of rain. Recent experiments show possible successful annual cropping for most years with above 13 inches of rain. May be replaced partly by forage crops in ranch-type farming system.
Oregon	850, 000	47	Columbia River Basin and scattered small sections elsewhere.	Necessary for crop production in sections with less than 14 inches of rain.
Idaho	800, 200	30	Dry-farmed sections in southern part of State.	Needed for crop production in southern Idaho; only for weed control elsewhere.
Utah	225, 000	42	Mountain valleys and other sections with 12 inches of rain and satisfactory soil conditions.	Essential for wheat production on dry lands.
California	750, 000–1, 000, 000		In dry-farmed sections throughout State, with varying emphasis under different conditions.	In a grain farming system, fallow every second or third year is an accepted practice. In mixed farming, it is used in rotation with pasture and other crops. Used to produce cereal hays on some ranches.
Summer-rainfall area				
Northern Plains:				
Montana	3, 250, 000	30	Practically all of Plains section and in most dry-farmed valleys.	For grain farming, fallow every second or third year is accepted practice. Replaced partly by corn in mixed farming but may be used for cash crops. Limited use for feed grains on ranches.

Footnote at end of table, p. 7.

TABLE 2.—*Summer-fallow acreage and use in 17 Western States*—Continued

Area and State	Area of fallow [1]	Dry-farmed land in fallow	Portion of State to which fallow is adapted	Place of fallow in the cropping system
Northern Plains—Con.	*Acres*	*Percent*		
North Dakota	2, 400, 000–3, 600, 000	10 to 15	Practiced chiefly in western half of State, but useful in other parts.	For grain farming, fallow is desirable to control weeds, conserve moisture, and stabilize production. Under diversified farming it is replaced partly by row crops. Not used on ranches unless cereal production is part of farming system.
South Dakota	225, 000	4	Approximately western half of State.	For grain farming, fallow is desirable to stabilize production and control weeds. In diversified farming it is largely replaced by row crops. May be used to a limited extent to produce feed grains on ranches.
Wyoming	216, 000	35	Eastern and particularly northeastern part of State.	80 to 90 percent of the winter wheat is grown on fallow; only a small percentage of other grains. In diversified farming it is used chiefly to produce a cash crop. May be used to a very limited extent for providing cereal hay on ranches.
Central Plains:				
Nebraska	1, 077, 900	7	Panhandle and southwestern counties to 100th meridian.	Used chiefly for winter wheat production. On diversified farms it is replaced mostly by corn and sorghums. On ranches it may be used to a limited extent to grow forage sorghums.
Colorado	1, 500, 000	--------	Principally in northeastern part of State; some elsewhere on suitable soils.	About 50 percent of winter wheat is on fallowed land. On diversified farms it may be used to grow a cash crop or to insure production of feed grain or forage. On ranches it might be used for winter rye pasture or to produce feed grain.
Kansas	1, 227, 000–3, 570, 000	4 to 12	Western 6 tiers of counties	Alternate fallow and crop in the western 2 of the 6 tiers of counties; fallow and 2 years of crop in central 2; and fallow and 3 years of crop in the eastern 2 tiers. Under diversified farming, fallow for principal crops; varied as condition justifies. Under a ranch economy some crops for feed should be grown on fallowed land.

Southern Plains:				
Oklahoma	222, 000–574, 000	2 to 8	Panhandle counties and a few southwestern counties.	Should be used chiefly in a flexible system, not as a regular practice. Under diversified farming it would be replaced chiefly by sorghums. Would be of little use in a ranch economy.
Texas	1, 978, 000		Wheat-producing section in High Plains.	Under grain farming it could be used to some extent in winter wheat production. Would be replaced chiefly by sorghums on diversified farms and would be of little use on ranches.
New Mexico	127, 700	6 to 20	Northeastern part of State	Limited use for winter wheat production on grain farms. Little or no use on diversified farms or on ranches.
Area too arid for dry farming				
Southwestern States:				
Nevada			Practically no dry farming in State.	Used on irrigated land on a heavy silt soil for improvement of structure.
Arizona			None; area of dry-farmed land in State only 40,000 acres.	

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[1] These figures are averages in some cases; in others, estimates obtained in a particular year. The figures are not strictly comparable but give an indication of the extent to which fallow is used in the different States.

WINTER-RAINFALL AREA

In the winter-rainfall area summer fallow was a standard practice long before it was used in the Great Plains and crops are regularly grown under lower rainfall than would be possible under Plains conditions. There is good general agreement that fallowing is necessary for crop production when precipitation is less than 14 to 15 inches, but few data for comparison are available. In the low-rainfall areas, responses to fallow have been so good and to other methods of production have been so poor that almost all of the crops have been produced on fallowed land.

Summer fallow was and still is practiced in areas with more than 15 inches of rain, but its use is diminishing. It has been replaced to a great extent by competitive crops such as peas and by use of fertilizers on land where rainfall is great enough to permit annual cropping to wheat.

Fallow in the winter-rainfall area is relatively easy to maintain, because little cultivation for weed control is needed during the dry summer period.

SUMMER-RAINFALL AREA

NORTHERN GREAT PLAINS

It will be noted that the percentage of summer fallow is much greater in Montana and Wyoming than it is in the Dakotas. This is due in part to the lower average rainfall in the dry-farmed sections of these States, but one of the greatest reasons is the better adaptation of winter wheat. This crop has not been successful in North Dakota, and it is adapted to only a small part of western South Dakota—confined chiefly to a few southern counties and to the vicinity of the Black Hills.

The higher percentage and acreage of fallow in North Dakota as compared with South Dakota are due to several causes. One is that a greater proportion of the dry-land section in North Dakota is under cultivation. Another is that a smaller percentage of row crops is grown and a greater percentage of grain is grown after grain, thus making fallow for weed control necessary. A sizable part of the fallow acreage in North Dakota is in the part of the State where fallow is primarily a weed-control practice.

The reason for high percentage of fallowed land in the dry-land section of Wyoming is that row crops are relatively unimportant and the chief grain crop, winter wheat, is grown mainly on fallowed land. It is estimated that 80 to 90 percent of the winter wheat in the State is grown on fallowed land and only 5 percent of the spring wheat.

Row crops are also of small importance in much of Montana, but a considerable part of the spring-sown grains are grown on fallowed land.

CENTRAL GREAT PLAINS

Fallow is much used in winter wheat production in western Kansas and Nebraska and in eastern Colorado. The need for and percentage of land in fallow decrease rapidly in Kansas and Nebraska with the distance eastward, and by the time the 100th meridian is reached the use of fallow must be based on considerations other than yield.

The central Great Plains area appears to be the only one where the response of a row crop to fallow is at all comparable with that of winter wheat. The grain and forage sorghums show such responses in the drier part of the area. In the potato section of western Nebraska the percentage increase on fallowed land is not large, but the increase in number of bushels combined with the greater percentage of marketable tubers makes fallowing a recommended practice.

SOUTHERN GREAT PLAINS

The place of fallow in the farming system is much less important in the southern Great Plains than in the other areas of the region. Its use is confined chiefly to winter wheat production in the High Plains section of Oklahoma and Texas and a small area in New Mexico. The efficiency of fallow appears to decrease somewhat with the distance south, because the period between harvest and seeding is long enough to make fallowing for weed control unnecessary. With the improvement of practices for controlling wind erosion, however, it is probable that fallowing may increase somewhat in importance, particularly if acreage restrictions are again imposed.

Dalhart appears to be the only experimental location in the southern Great Plains where the response of a row crop to fallow is great enough to justify growing any of it by that method.

Area Too Arid for Dry Farming

As indicated in table 2, little dry farming is practiced in Nevada and Arizona. It is a curious fact, however, that fallow is intermittently used to improve soil structure on an area of very heavily irrigated land on the Newlands project.

RELATIVE YIELDS OF SMALL GRAINS ON FALLOWED AND CROPPED LAND

The relative yields of small grains on fallowed land, on land where a small-grain crop has been grown, and on land where some crop competitive with fallow has been grown are presented in tables 3 to 6.[3] The data in these tables have been abstracted from reports sent in by State representatives, from the records of this Division, and from published material.

The average acre yields of winter and spring wheats, and in some cases winter rye, on fallowed land are given. Yields in other sequences are expressed as percentages obtained by dividing the yield on fallowed land by the yield under the specified sequence. Acre yields of the other spring-sown small grains are not given, as the yield of spring wheat is considered to be generally representative of spring grains. In all cases a percentage yield under a sequence is a comparison with the yield on fallowed land planted to the same crop. The percentage system was adopted because periods of different lengths may enter into the different comparisons, and actual yields could not be used without an undue amount of explanation or duplication of figures. The actual yields of spring and winter wheat are given only as an indication of the relative adaptation of spring-sown and fall-sown grains to the different parts of the region.

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[3] The field staff of the Division of Soil Management and Irrigation contributed the greater part of the material for these tables.

The actual yields of spring and winter wheat are indicative of the yield levels at the different locations. Comparisons are general rather than exact, because different periods of years are involved.

The yields of crops competitive with fallow, such as corn, sorghum, and peas, could not be given without greatly increasing the size of tables. It should be kept in mind, however, that use of such crops depends both on their value as crops and on their effect on yields of crops following them.

The crops grown in the different parts of the summer-fallow area vary considerably, and for convenience the different parts of the area are discussed separately.

WINTER-RAINFALL AREA

Data for the winter-rainfall area are presented in table 3.

In most of the arid part of the area little attempt is made to grow crops on other than fallowed land. Another striking feature is the high percentage response to fallow at Pullman and Moscow, where the rainfall is more than 20 inches. This is caused by lack of nitrogen, and the percentage difference in yield can be greatly reduced by application of that element to the crop on land that has not been fallowed. Peas are well adapted to the area, and much of the acreage formerly fallowed is now planted to that crop.

Pendleton, with a rainfall of more than 15 inches, and Moro, with a rainfall of about 11 inches, show some interesting contrasts. Pendleton shows the highest percentage yield response to fallow of any station, but the percentage difference may be reduced more than half by use of nitrogenous fertilizer on the continuously cropped land. Yields of spring wheat after peas at Moro are nearly equal to those on fallowed land, but at Pendleton are a third lower. At Pendleton, however, peas are so productive that they make a very profitable addition to the cropping system.

It will be noted that for the area in general, yields on pea land are little below those on fallowed land. The extent to which peas replace fallow in the cropping system is established primarily by their value as a crop.

SUMMER-RAINFALL AREA

NORTHERN GREAT PLAINS

Results for the northern Great Plains are given in table 4.

Throughout the northern Great Plains, yields on cornland are intermediate between those of wheat after wheat and wheat on fallowed land. Where corn is reasonably productive, it can replace fallow to the extent that it can be profitably used in the farming system. Average yields are generally too low to consider growing corn for a cash crop.

TABLE 3.—*Actual acre yields of wheat on fallowed land, and yields of grains on fallowed land as a percentage of grain after grain, or as a percentage of grain following some other crop, in the winter-rainfall area*

State and location	Years	Average yield		Yield of grain on fallow as a percentage of the same grain after a small-grain crop				Yield of grain on fallowed land as a percentage of the same grain after—					
								Corn				Peas	
		Winter wheat	Spring wheat	Winter wheat	Spring wheat	Oats	Barley	Winter wheat	Spring wheat	Oats	Barley	Winter wheat	Spring wheat
		Bushels	*Bushels*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Washington, Pullman	1922–45	[1] 44. 1		221				162				121	
Oregon:													
Moro	1912–50	25. 4	23. 8		190		184	137	111	122	137	141	103
Pendleton	1931–50	41. 7	42. 2	296	281	203		139	211			142	137
Idaho:													
Moscow	1914–50	50. 0		253				154				115	
Tetonia	1940–49	24. 4		216									
Utah, Nephi	1904–45	23. 4		234								116	
California, Davis	1914–23	40. 0		177								95	

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[1] Includes some years when spring wheat was grown.

TABLE 4.—*Actual acre yields of wheat on fallowed land, and yields of grains on fallowed land as a percentage of grain after grain, or as a percentage of grain following corn, in the northern Great Plains, for various periods*

State and location	Years	Average yield		Yield of grain on fallow as a percentage of the same grain after a small-grain crop				Yield of grain on fallowed land as a percentage of the same grain after corn			
		Winter wheat	Spring wheat	Winter wheat	Spring wheat	Oats	Barley	Winter wheat	Spring wheat	Oats	Barley
Montana:		*Bushels*	*Bushels*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Havre	1917–50	[1] 12. 2	14. 8	[1] 284	166	163	180	[1] 147	128	137	136
Moccasin	1910–50	[1] 18. 1	17. 3	[1] 210	133	146	158	[1] 116	118	122	137
Huntley	1915–50	[1] 22. 4	16. 8	[1] 249	179	175	193	[1] 130	131	140	120
North Dakota:											
Edgeley	1941–45		29. 3		137						
Langdon	1941–45		31. 3		170						
Mandan	1915–50		21. 9		147	165	164		132	134	146
Dickinson	1908–50		20. 8		158	153	141		116	136	107
Hettinger	1912–22		16. 9		147	138	134		111	119	
Williston	1910–20		18. 6		154	175	221		122	121	121
South Dakota:											
Brookings	1899–1902		16. 5		135				104		
Highmore	1912–30		15. 9		161	163	171		96	118	114
Belle Fourche	1909–49	21. 9	21. 8	165	157	157	150	124	127	132	125
Ardmore	1913–32	18. 4	19. 1	209	159	151	165	143	116	128	122
Wyoming:											
Sheridan	1918–50	31. 0	24. 7	191	167	154	157	117	120	123	120
Gillette	1938–50	20. 8						131			
Archer	1914–18	14. 1	12. 8	180	173	148	179	137	133	99	127

[1] This does not include the spring wheat produced when a stand of winter wheat failed to survive.

The rainfall at Moccasin is higher than at the other Montana stations and the soil probably is shallower. This accounts for the comparatively low response of spring grains to fallow at Moccasin.

It will be noted that in only one instance is the yield of a spring grain on fallow double that of the same crop on small-grain land. Fallow has an established place in grain production, because economy of operation, distribution of labor, reduced number of failures, and weed control frequently more than compensate for the lower grain production on a given number of acres. Fallow does not need to double the acre yield of grain to be a desirable or profitable practice.

In the part of the area where both winter and spring wheat can be grown, the percentage increase over small-grain land is considerably higher for winter than for spring wheat.

CENTRAL GREAT PLAINS

Results for the central Great Plains are given in table 5.

This area is primarily a winter-wheat area, although spring grains are grown to some extent, principally in the northern and western part. As in other areas, the response of winter wheat to fallow is greater than that of the spring wheat. Responses of the different spring grains are much the same, although there seems to be a tendency for barley to be slightly more productive than the other spring grains on fallowed and corn ground.

The diminishing percentage response to fallow as the rainfall is increased can be noted by comparing results from Scottsbluff, Alliance, Akron, Colby, and Garden City with those from North Platte and Hays. Yields in bushels to the acre after fallowing are as much above those on cropped land at North Platte and Hays as they are at drier locations, but yields on cropped land are so much higher at North Platte and Hays that fallowing becomes less necessary.

The value of cornland as a preparation for small grain is much lower than in the northern Plains, and in many cases yields on cornland are little or no higher than those after small grains.

Sorghum land as a preparation for winter grain enters the picture in the central Plains. Yields on sorghum land are generally much lower than on corn ground and frequently lower than on small-grain land. It is generally recognized that winter wheat cannot follow sorghums to advantage, and sorghum land is frequently fallowed before a grain crop is planted.

SOUTHERN GREAT PLAINS

Data for the southern Great Plains are presented in table 6.

These data reveal why fallow does not play a more important part in the agriculture of this area. At no location is the yield on fallowed land enough higher than on small-grain land to make its production by that method a "must." The percentage increase on fallowed land at Tucumcari is high enough to suggest that system of production if winter wheat is to be grown. However, yields of winter wheat have been too low at Tucumcari for the crop to be grown except under unusual conditions, and the high percentage represents only a few bushels.

TABLE 5.—*Actual acre yields of wheat on fallowed land, and yields of grains on fallowed land as a percentage of grain after grain, or as a percentage of grain following some other crop, in the central Great Plains, for various periods*

State and location	Years	Average yield		Yield of grain on fallow as a percentage of the same grain after a small-grain crop				Yield of grain on fallowed land as a percentage of same grain after—				
								Corn				Sorghum
		Winter wheat	Spring wheat	Winter wheat	Spring wheat	Oats	Barley	Winter wheat	Spring wheat	Oats	Barley	Winter wheat
Nebraska:		*Bushels*	*Bushels*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North Platte	1936–50	26. 5	12. 1	189	149	136	187	204	153	168	166	230
Scottsbluff	1912–21	16. 7	15. 4	220	188	157	209	134	130	118	178	
Alliance	1931–50	18. 1		212				150				
Colorado:												
Akron	1909–49	17. 8	11. 4	234	165	163	198	163	125	135	160	160
Kansas:												
Hays	1908–45	22. 5	9. 5	137	148	148	149	150		127	131	214
Colby	1915–50	17. 6	8. 4	198	156	155	176	187	153	186	190	175
Garden City	1929–44	16. 6		195								307
Meade Field	1941–46	13. 7		201								
Dodge Field	1939–50	26. 6		165		141	161					

Table 6.—*Actual acre yields of wheat on fallowed land, and yields of grains on fallowed land as a percentage of grain after grain, or as a percentage of grain following some other crop, in the southern Great Plains, for various periods*

State and location	Years	Average yield		Yield of grain on fallow as a percentage of the same grain after a small-grain crop		Yield of winter wheat on fallowed land as a percentage of winter wheat after crop indicated			
		Winter wheat	Winter rye	Winter wheat	Winter rye	Corn	Sorghum	Cotton	Cowpeas
Oklahoma:									
Woodward:		*Bushels*	*Bushels*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Field A [1]	1915–48	22. 2	15. 7	128	127	120	172	----------	120
Field B [2]	1933–48	25. 1	----------	133	----------	133	202	173	129
Lawton	1924–48	21. 2	----------	133	----------	----------	----------	150	126
Goodwell	1926–35	13. 9	----------	158	----------	----------	----------	----------	----------
Texas:									
Big Spring	1917–49	5. 3	----------	104	----------	----------	----------	----------	100
Dalhart	1927–49	10. 0	8. 2	154	126	----------	----------	----------	----------
Amarillo (BPI)	1907–19	10. 7	----------	119	----------	----------	----------	----------	----------
Amarillo (SCS)	1942–49	23. 2	----------	166	----------	----------	----------	----------	----------
New Mexico, Tucumcari	1930–46	10. 5	12. 1	191	170	----------	----------	----------	----------

[1] Pratt loamy fine sand.
[2] Weymouth fine sandy loam.

The quantity of fallow purposely introduced into farming systems in the wheat-producing part of the southern High Plains is likely to be fixed by factors that determine whether production per acre or production per farm is more important.

Fallow has an important place as an emergency practice on land regularly planted to wheat. When winter wheat has failed, it is generally more profitable to fallow the land than to grow a crop of sorghum and then plant wheat. The reduction in wheat yield after sorghum may more than offset the benefit of the quantity of sorghum produced.

DISCUSSION

The value of summer fallow is that fallow ground stores water and makes it available to subsequent crops in larger quantities than could be retained under an annual cropping system. For this reason it is of little use on soils too sandy to hold material quantities of water, on shallow soils, or on soils in areas where the rainfall is such that most of the water-holding capacity of the soil is utilized under annual crop production. It may be an unsafe practice in areas where the land cannot be protected from wind erosion during the fallow period.

The effect of a year of fallow on the soil is much the same as that of a cultivated crop. The reduction in soil organic matter in a fallow-crop system is considerably greater than in a grain farming system. The continued use of a fallow-crop system without soil-improving crops or practices will eventually result in lower crop yields. The time that it will take to reach such a condition depends on the original fertility level of the soil, the quantity of nutrients removed or lost from the soil annually, and the precipitation.

Soils in the upper 15-inch rainfall belt of the Columbia River basin are reaching a condition in which lack of nitrogen is affecting wheat yields. This is reflected in responses to nitrogen fertilizers and in the low protein content of wheat produced in recent years. The nitrogen limitation may be expected to move gradually to the lower rainfall areas.

Nitrogen and, on some soils, phosphorus deficiencies are evident on the eastern edge of the Great Plains, but have not as yet materially affected yields in the drier part, where fallowing is most necessary. The most practicable means of postponing or preventing an eventual nitrogen deficiency appears to be the use of more grasses, legumes, and livestock in the farming system.

It is not possible to state what percentage increase in acre yield is needed to justify summer fallowing, because so many factors enter in.

In a small-grain farming system, an increase of 100 percent in acre yield on fallowed land makes the use of fallow almost imperative. It is still a highly desirable practice when the increase falls considerably below 100 percent, because it is cheaper to keep part of the land fallow and part in crop than to grow a crop on all of the land. Other factors also make fallow desirable, as stability of production, distribution of labor, and—particularly where the interval between harvest and seeding or winter is short—weed control.

The same factor is not equally important under all conditions. If production costs are fairly stable, the prices obtained for the crops determine the extent to which costs affect profits. It takes a good many bushels of 30-cent wheat to make up the difference in expense between keeping half of the land in crop and all of it in crop. It does not take many bushels of $2 wheat to make up the same difference.

In the area where fallow is essential to successful crop production, the tendency is to deplore the fact that the practice must be used but to admit its necessity. Where replacement crops can be grown or where other methods of cultivation are reasonably effective, the value of fallow is fixed by factors other than total yield. A limited amount of fallow is recommended as a means of stabilizing the farm income and of assuring supplies of food for livestock in areas where its use could not possibly be justified on a strictly dollar-and-cents basis.

Where fallow is necessary or nearly necessary for successful crop production, it has a stable place in the economy of that area. Where its use is optional, the acreage may be expected to vary from year to year and from farm to farm with economic and moisture conditions and with the type of farming practiced.

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